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09/511,398	02/23/2000	Tomohiro Okumura	00177/530809	3756

7590

07/02/2003

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EXAMINER

PADGETT, MARIANNE L

ART UNIT

PAPER NUMBER

1762

16

DATE MAILED: 07/02/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/511,398

Applicant(s)

Okumura et al

Examiner

M.L. Padgett

Group Art Unit

1762

— The MAILING DATE of this communication appears on the cover sheet beneath the correspondence address —

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, such period shall, by default, expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

☒ Responsive to communication(s) filed on 3/20/03

☐ This action is **FINAL**.

☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

Disposition of Claims

☒ Claim(s) 56-79 is/are pending in the application.

Of the above claim(s) 56-63, 68-75 is/are withdrawn from consideration.

☐ Claim(s) _____ is/are allowed.

☒ Claim(s) 64-67 + 76-79 is/are rejected.

☐ Claim(s) _____ is/are objected to.

☐ Claim(s) _____ are subject to restriction or election requirement

Application Papers

☐ The proposed drawing correction, filed on _____ is ☐ approved ☐ disapproved.

☐ The drawing(s) filed on _____ is/are objected to by the Examiner

☐ The specification is objected to by the Examiner.

☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119 (a)-(d)

☐ Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119 (a)-(d).

☐ All ☐ Some* ☐ None of the:

☐ Certified copies of the priority documents have been received.

☐ Certified copies of the priority documents have been received in Application No. _____

☐ Copies of the certified copies of the priority documents have been received in this national stage application from the International Bureau (PCT Rule 17.2(a))

*Certified copies not received: _____

Attachment(s)

☐ Information Disclosure Statement(s), PTO-1449, Paper No(s). _____

☐ Interview Summary, PTO-413

☐ Notice of Reference(s) Cited, PTO-892

☐ Notice of Informal Patent Application, PTO-152

☐ Notice of Draftsperson's Patent Drawing Review, PTO-948

☐ Other _____

Office Action Summary

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1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 3/20/03 has been entered.

2. In accordance with the restriction of paper # 8, and the election in paper # 9, where group I, plasma process and apparatus, employing an annular plasma trap/groove; and species (2) employing an antenna were chosen, claims 54-67 and 76-79 are elected claims/species, while claims 56-63 and 68-75 are withdrawn as non-elected. No claims are currently generic.

3. The wording of applicants new claims, along with the defining terms supplied to paragraph [0114] of the specification, as applicable to all the figures' groove configurations, remove the 112 1st and 2nd paragraphs problems, discussed on p. 2-3 of paper # 13.

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

5. Claims 64, 67 and 76-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Higuchi et al, in view of Chen et al (5,824,605).

Higuchi et al and Chen et al (605) were discussed in section 5 of paper # 13, and remains pertinent to the new claims. With respect to the newly submitted claims, it is noted that the surface area of the window inside the "annular groove" of Higuchi et al would be expected to be within the claimed 0.5 to 2.5 times as large range of applicants, which covers $\frac{1}{2}$ the area to $2\frac{1}{2}$ times larger, as the illustrations of Figs. 9-11 indicate that the planar window surface opposite the substrate has just slightly a larger diameter than the wafer substrate W. Col. 2, line 32 indicates the wafer size of 8-12 inch (203 & 304 mm), while col. 17, line 36 give 160 mm for the recessed portion of the window. As illustrated (Fig 11 A+B) and discussed (col. 17-18), the configuration of the groove is sufficient to generate a high-density and uniform plasma in a "horizontally wide region". Higuchi et al differs from the claims by not giving a range of widths for the groove, and by not having an "outer-side face" wall of the groove that is "inside" or different from the side wall of the chamber. While the groove width is not discussed, other dimensions are given, with Fig. 9 illustrating a groove depth $H_1=5\text{cm}$ (50mm), and a distance $H_2 = 30$ to 150 mm, hence while one can not assume that figures are to scale, the groove width is illustrated as approximately the same size as the depth of the recess or groove, so it would have been suggestive to, thus obvious to one of ordinary skill in the art that similar dimension would have been employed therefore. Furthermore, as the distribution of the plasma, as shown in Figs. 10-11, is effected by the space available, as well as the pressure of the electromagnetic fields, it would have been a matter of routine experimentation to adjust/allow for groove width to accommodate the taught plasma distributions.

As illustrated in Fig. 15, Higuchi et al also contemplates alternate shapes for their window, other than the single planar surface with side walls, in order to adjust plasma distributions. Chen et al (605) who is also using window shape to produce planar plasmas (col. 2, lines 5- 61; col. 3, lines 9-46; col. 4, lines 5-16⁺ and 46-col. 5, line 30), provides illustration of 2 additional window/groove configurations in Fig. 2 and 4, where reference # 18 (or 18a + 18b) is the window, where indented regions are shown in both figures, and both illustrate sidewalls of these inclinations or grooves, which are inside the inner surface of the vacuum chamber, and may or may not be part of the window. It is noted in independent claims 65 and 78, the groove is required to be "outside" the window, and while the amendment to [0114] defined "outside" with respect to the vertical center axis of the vacuum chamber, it is not defined with respect to the window. Several possible meanings may be considered. Such as, outside as in no part of the groove is a part of the window, which is consistent with applicants' Fig. 10, but not Fig. 11 or 12; or "outside" as in the groove is not contained within or enclosed by the window, which is consistent with all applicants figures; or an intermediate interpretation, where at least one wall (the outside one) of the groove is not part of the window, so that the window does not enclose the groove. None of the figures (Higuchi or Chen) fit the first interpretation, all of the figures (10-11 + 13-15 Higuchi and 2 + 4 of Chen et al) fit the second, while Higuchi's cited figures and Fig. 2 of Chen et al correspond to the last recited possible interpretation, hence it is reasonable to conclude that for the claims as presently written, this "outside of ... window" feature is covered.

Given the teachings on plasma distribution of both Higuchi et al and Chen et al, it would have been obvious to one of ordinary skill in the art to modify

window/groove/chamber configurations of Higuchi et al, as they are shown to produce equivalent uniformly distributed planar plasmas, and further provide for meaning of gas distribution through the window area, which requires means for inputting the gas, thus using space in the side of the chamber, providing motivation and/or reasons why one would not necessarily have the bare chamber wall right next to the groove and/or as one if its walls.

6. Claims 64 and 76 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bhardwaj et al, in view of Higuchi et al, as discussed in paper # 13 (sections 5 and 6) and above.

For the new claims, the reasons for obviousness of the claimed frequency, as obvious to apply to Bhardwaj et al in view of Higuchi et al remain the same. Note that the various grooves of Bhardwaj et al may be considered "outside" the window(s) as discussed above, and while specific widths of grooves or dimensions between annular windows or the outside annular window and wall are not provided, it would have been obvious to one of ordinary skill that they would have been determined by the particular configuration employed and chamber dimension size of area being treated, and the need to create a uniform plasma, thus expected to be sufficiently close to enable having no gaps or perturbation in the plasma distribution, especially as Bhardwaj et al teach "the antennae are separated by at least twice the skin depth of the intended plasma" (col. 2, lines 22-29), suggestive of relative dimensions, but not specific ones. The examiner

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has no means to translate this teaching in to specific lengths. It is noted while Higuchi et al has the claimed window areas, it is uncertain whether or not configurations of

Bhardwaj et al would or would not, and there appears to be no way to calculate such reliably, so the claims requiring 0.5-2.5 time comparative surface areas are not herein included.

7. Claims 64-67 and 76-79 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tomoyasu, optionally considering Higuchi et al, discussed in sections 7 & 8 of paper # 13.

The meaning of "outside of ... window" is pertinent to how and if Tomoyasu is applied. In Figures 14-15, 114 is the window, while 116 are barriers made of quartz that are perpendicular to the window and the antenna, have lengths of 10-20mm, and effect the plasma distribution, specifically the electrons therein. The configuration of Figures 14-15 (col. 13, lines 450 col. 14, line 24) make multiple grooves, all of which might be considered outside the window, but also "at the window", as they are at its outer surface, and not necessarily considered part of the window. Note that the outside wall of the outer most concentric barrier pair which makes the outer most groove, is inside the inner surface of the side wall of the chamber. Dimension of the width of these annular grooves are not provided, but in the analogous alternative embodiment (Figs. 11-12; col. 13, lines 10-35, esp. lines 19-20), the lengths of the barriers are given as 10-20mm, which would be the expected length in the Figs. 14-15 embodiment also. As the cross-sectional dimensions of the annular groove are shown as square, one of ordinary skill would have expected approximately like dimensions for the width of the

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groove. Also, the configuration of the window with respect to the substrate would have been expected to be analogous to Figure 11, hence overall window area slightly larger than substrate, hence the window area inside the outer most groove of Tomoyasu would have been expected to be greater than $\frac{1}{2}$ the area of the substrate.

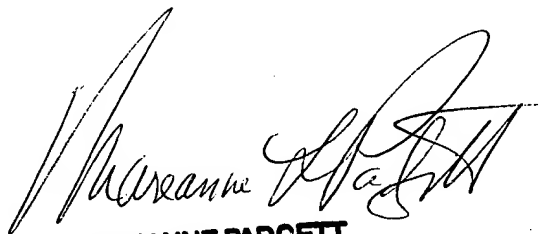
8. Claims 66-67 and 78-79 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

The phrase "outside of said dielectric window" is considered ambiguous, as the multiple possible meanings as discussed above in section 4, may be applied to the phrasing, but exactly which is intended is unclear. For purposes of the art rejection, broadest possible meanings may be applied.

9. Applicant's arguments filed 3/20/03 and discussed above have been fully considered but they are not persuasive.

Applicant's arguments with respect to claims 64-67 and 76-79 have been considered but are moot in view of the new ground(s) of rejection.

10. Any inquiry concerning this communication or earlier communications from the examiner should be directed to M L. Padgett whose telephone number is 703-308-2336 on M-F, from about 8:30 am – 4:30 pm; FAX # (703) 872-9310 (regular); 872-9311 (after final); or 305-6078 (informal).



MARIANNE PADGETT
PRIMARY EXAMINER

M. L. Padgett/mn 6/10/03
July 2, 2003